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## We claim:

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- 1. A process for synthesis of ultrafine rutile phase titanium dioxide particles through vapor phase hydrolysis of titanium tetrachloride comprising the step of:
  - (a) hydrolyzing a mixture of TiCl<sub>4</sub> and H<sub>2</sub>O and a dopant in vapour phase in an aerosol reactor;
  - (b) collecting amorphous or anatase titanium dioxide powder formed as dry powders;
  - (c) calcining the dry powder to obtain rutile phase titanium dioxide.
- 2. A process as claimed in claim 1 wherein the amorphous particles of titanium dioxide are calcined at a temperature in the range of 150 to 400°C and for a period in the range of 1 to 4 hrs to generate rutile particles.
- 3. A process as claimed in claim 1 wherein the dopant contains a carbon atom and is selected from the group consisting of an aliphatic alcohol, an aromatic hydrocarbon, and any mixture thereof.
- 4. A process as claimed in claim 3 wherein the dopant is ethanol.
- 15 5. A process as claimed in claim 1 wherein the molar concentration of the dopant is 1 to 10 based on the water vapour.
  - 6. A process as claimed in claim 1 wherein the reaction mixture contains from 1 to 10 % ethanol on a molar basis based on TiCl<sub>4</sub>.
- 7. A process as claimed in claim 1 wherein the flow rate of TiCl<sub>4</sub> is in the range of 10 cm<sup>3</sup>/min to 200 cm<sup>3</sup>/min.
  - 8. A process as claimed in claim 1 wherein the TiCl<sub>4</sub> vapor concentration inside the reactor is in the range of  $7 \times 10^{-4}$  mol/min to  $1 \times 10^{-2}$  mol/min.
  - 9. A process as claimed in claim 1 wherein the flow rate of water vapour is in the range of 240 to 1500 cm<sup>3</sup>/min, preferably from 500 to 1000 cm<sup>3</sup>/min.
- 25 10. A process as claimed in claim 1 wherein the temperature at the exit of the aerosol reactor is maintained at less than 100°C for obtaining titanium dioxide particles having anatase phase.
  - 11. A process as claimed in claim 1 wherein the aerosol reactor is externally heated in order to avoid particle coating on the walls through thermophoresis.
- A process as claimed in claim 1 wherein the aerosol reactor comprises of 3 tube concentric jet assembly wherein TiCl<sub>4</sub> is introduced into the innermost tube, dopant is introduced into the outermost tube and water vapor is introduced into the middle tube.
  - 13. A process as claimed in claim 12 wherein the 3-tube assembly comprises a concentric arrangement of three inconel tubes at the entrance of the aerosol reactor.

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- 14. A process as claimed in claim 12 wherein vapor phase TiCl<sub>4</sub> is introduced into a center tube of the three concentric inconel tubes.
- 15. A process as claimed in claim 1 wherein the vapor phase TiCl<sub>4</sub> is formed by bubbling an inert gas through TiCl<sub>4</sub> liquid.
- A process as claimed in claim 1 wherein the inert gas is selected from the group consisting of argon, nitrogen, krypton, helium and any mixture thereof.
  - 17. A process as claimed in claim 1 wherein the molar ratio of water to titanium tetra chloride in the feed is in the range 10 to 15.
  - 18. A process as claimed in claim 1 wherein the water vapor is formed by bubbling air or inert gases through water under superheated condition.
    - 19. A process as claimed in claim 1 wherein the reactor wall temperature is from 200 to 450°C.
  - 20. A process as claimed in claim 1 wherein the rutile titanium dioxide particles formed have an average diameter in the range of from 25 to 150 nanometers.
- 15 21. A vapor phase process for the synthesis of ultrafine rutile titanium dioxide powders carried out in an aerosol reactor comprising the steps of:
  - (a) vaporizing a titanium chloride liquid, water and dopant such as ethanol separately for generating a reactant mixture;
  - (b) hydrolyzing TiCl<sub>4</sub>, H<sub>2</sub>O and dopant in vapour phase mixture in a continuous aerosol reactor under non-isothermal conditions at temperature in the range 80 to 135°C;
  - (c) collecting amorphous and anatase phase titanium dioxide powder as dry powder;
  - (d) calcining the titanium dioxide particles having the amorphous phase in the temperature ange of 150-400°C and time duration in the range of 1 to 4 hrs. to obtain titanium dioxide particles with rutile phase.

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